

Interactive comment on “An empirical model (CH-Therm-2018) of the thermospheric mass density derived from CHAMP” by Chao Xiong et al.

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Title : An empirical model (CH-Therm-2018) of the thermospheric mass density derived from CHAMP

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It is a nice study, which complements previous global mass density studies based on the same CHAMP accelerometer data. This one appears to be built on a simpler set of

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functions, e.g., in contrast to empirical orthogonal functions in the papers of Lei et al., 2012 and 2013.

However, I'd like to make some comments and address some critical items of the method used.

First of all, the assumption of a constant scale height in global scale and for all seasons and local times (page 3, bottom paragraph) seems to be unjustified and might lead to apparent abnormal distortions in some of the deduced model parameters. It implies that the neutral temperature is assumed to be constant throughout, while it actually varies at least within a range of factor 2 to 3. The connection (normalisation) to an other empirical model or an iterative approach are a practicable alternative used elsewhere already many times.

It is not explicitly stated in the manuscript - do you use the data set based on the work of Doornbos et al., 2010, or some different approach (page 3, section 2.1)?

The reference height is said to be at 310 km with a fixed (?) mass density " ρ_0 " of 10^{-12} kg/m^3 (page 6, line 15). I suppose, it's a guiding or reference mass density. Equations (3) and (4) use the same " ρ_0 " parameter obviously in a different meaning; the values for the latter are given in Table 1 as ~ 0.102 and ~ 0.077 for the higher and lower solar activity level, respectively. This should be clarified.

You describe extensively the equinox asymmetry between \sim March and \sim September, but does not mention the annual asymmetry at all, although this is clearly seen as a striking difference between the solstice periods, e.g., in Fig. 4, middle panels, but less obvious as an interhemispheric difference between the December and the June solstice. The missing of the latter might be due to the assumption of the globally constant scale height, mentioned before.

Minors:

page 8, line 9: "depends"

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Fig. 7, the insert says "JB2008-HWM14" and gives different numbers of the medium value and the stddev as in the text (page 13, line 5). Is this done here by inclusion of the neutral wind model HWM14? Has the neutral wind been used to correct the mass density (accelerometer) measurements?

Similarly, there is a difference between text and insert with regard to the model CH-Therm-2018 or -2017?

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